

Overview of the Green Infrastructure Study

Chicago Metropolitan Agency for Planning
Environment and Natural Resources
Committee Meeting
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Background

- **P.A. 96-0026**, Green Infrastructure for Clean Water Act, signed into law in summer, 2009.
- A **Green Infrastructure Study** is mandated under § 15
 - **Illinois EPA** to report to General Assembly by June 30, 2010 – we are advising Illinois EPA on this report
 - Report to review “the latest available scientific and institutional knowledge to evaluate and document” Green Infrastructure practices for urban stormwater management

Green Infrastructure Study

- Illinois EPA contracted with UIC, the Chicago Metropolitan Agency for Planning (CMAP), the Center for Neighborhood Technology (CNT), and the Illinois-Indiana Sea Grant College Program (IISGCP) to undertake the study
- UIC, CMAP, CNT and IISGCP developed their work programs and budgets during the summer, and began work on the study in September (research now about 50% over)
- We'd appreciate your advice concerning:
 - whether we're looking at the right things and
 - whether some of the things we're looking at should be emphasized over others

Scope of the Study: UIC

- (a) Nature and extent of urban stormwater impacts on **water quality** in watersheds in Illinois
- (b) ...the **effectiveness** of green infrastructure practices to achieve such standards.
- (g) The feasibility and consequences of **devoting 20% of the Water Revolving Fund** to Green Infrastructure, water and energy efficiency improvements and **other environmentally innovative activities** on a long-term basis [UIC with assistance from CNT]

UIC Science Team Goals

1. Assess & compare the effectiveness of various kinds of green infrastructure
2. Use modeling to understand the role of spatial scale and pattern on effectiveness

GOAL 1

- Assess & compare the effectiveness of various kinds of green infrastructure
 - Review of scientific literature

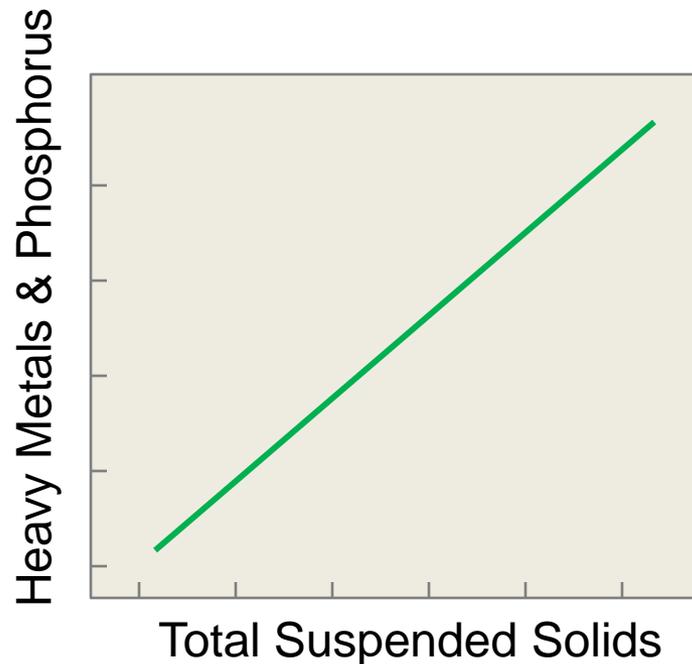
Literature Review

Kinds of green infrastructure:

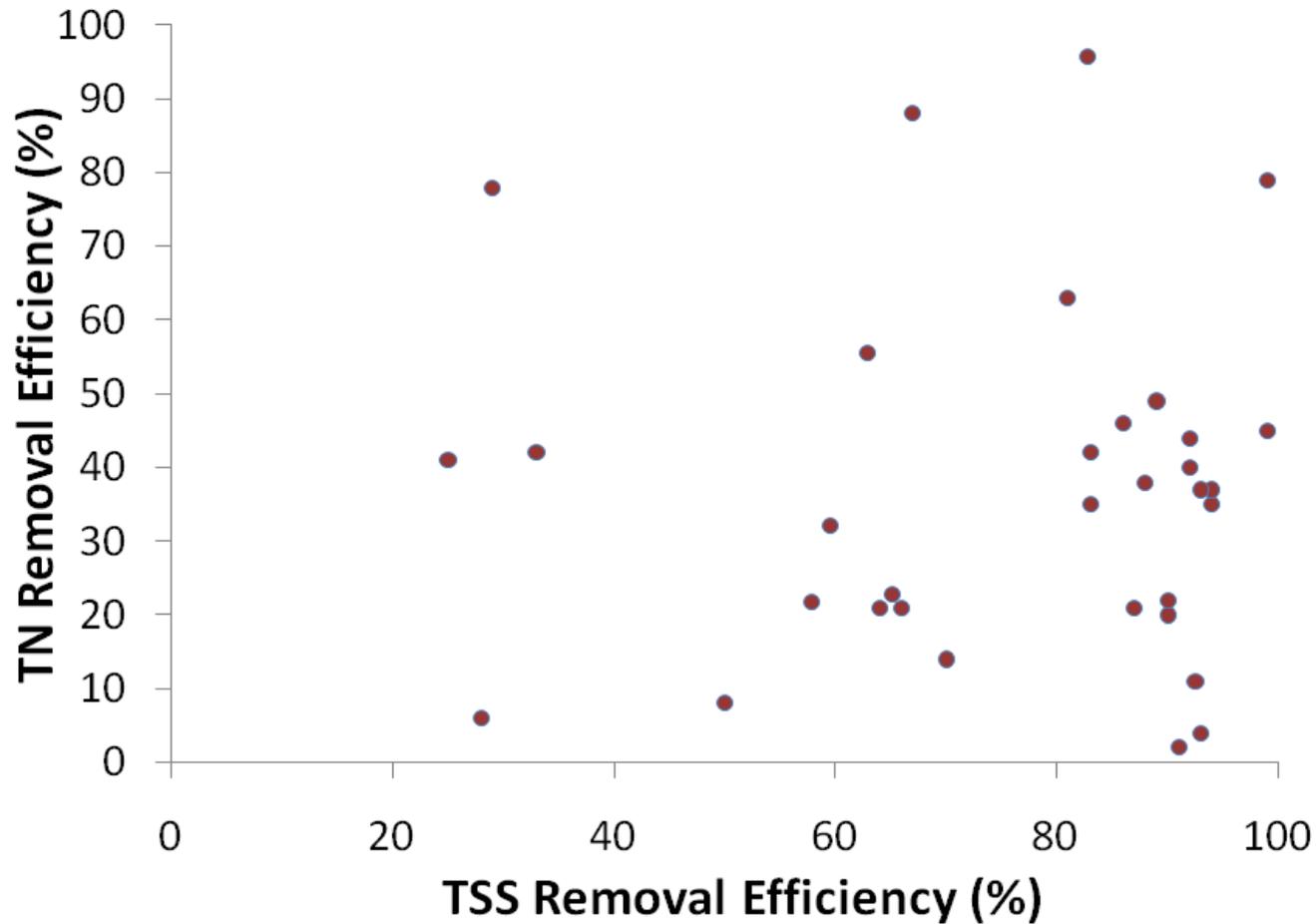
- **Infiltration** Vegetated systems; swales, rain gardens
- **Buffer** Vegetated strip along a stream
- **Detention** Water is detained to reduce peak flow
- **Permeable Pavement** Allows water to infiltrate into soil
- **Filtration** Filters pollutants out of storm water
- **Green Roof** Designed to reduce runoff
- **Constructed Wetland** Helps reduce runoff volume and pollution

Variables of Interest

- Volume
- Quality
 - How to measure?
 - TSS?



Total Suspended Solids vs. Total Nitrogen

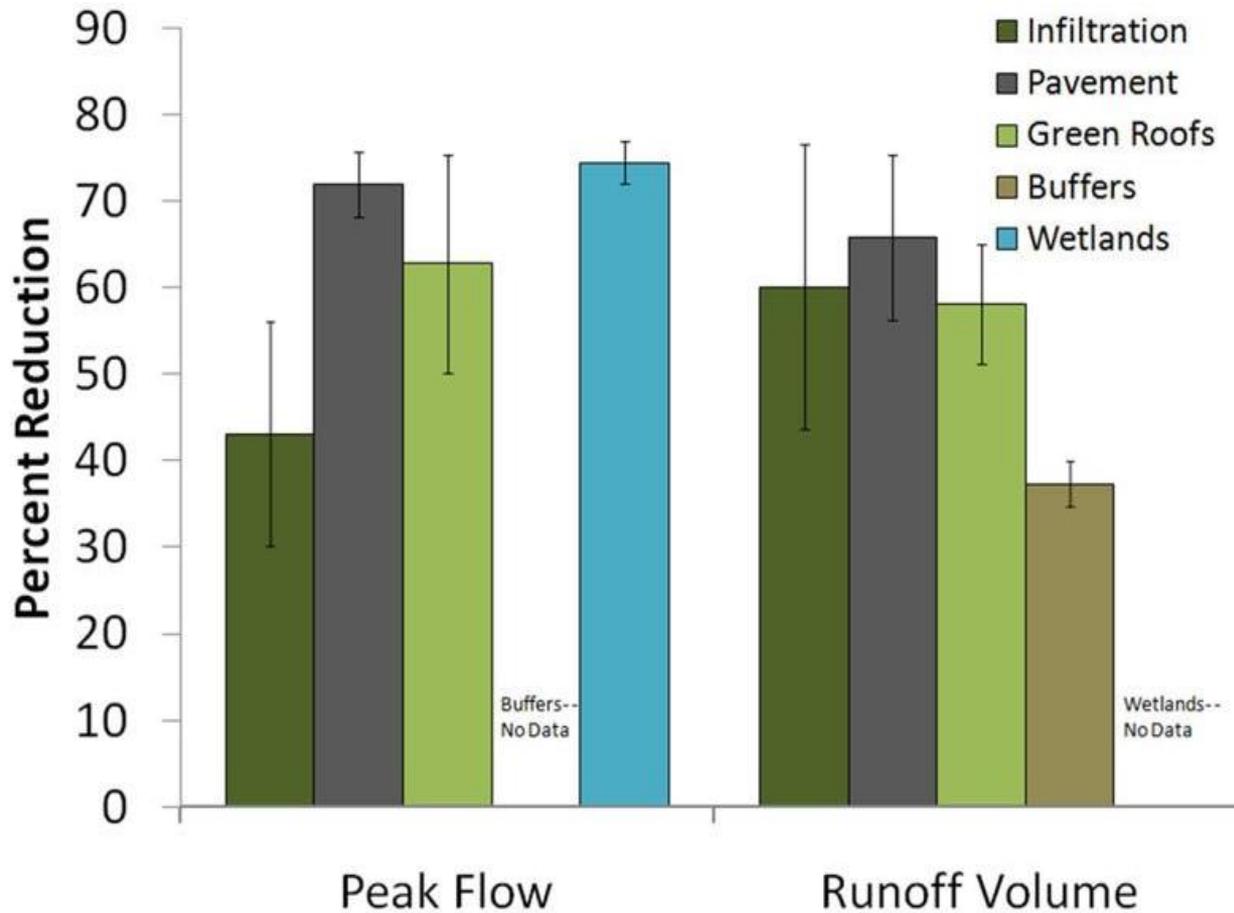


Preliminary Results

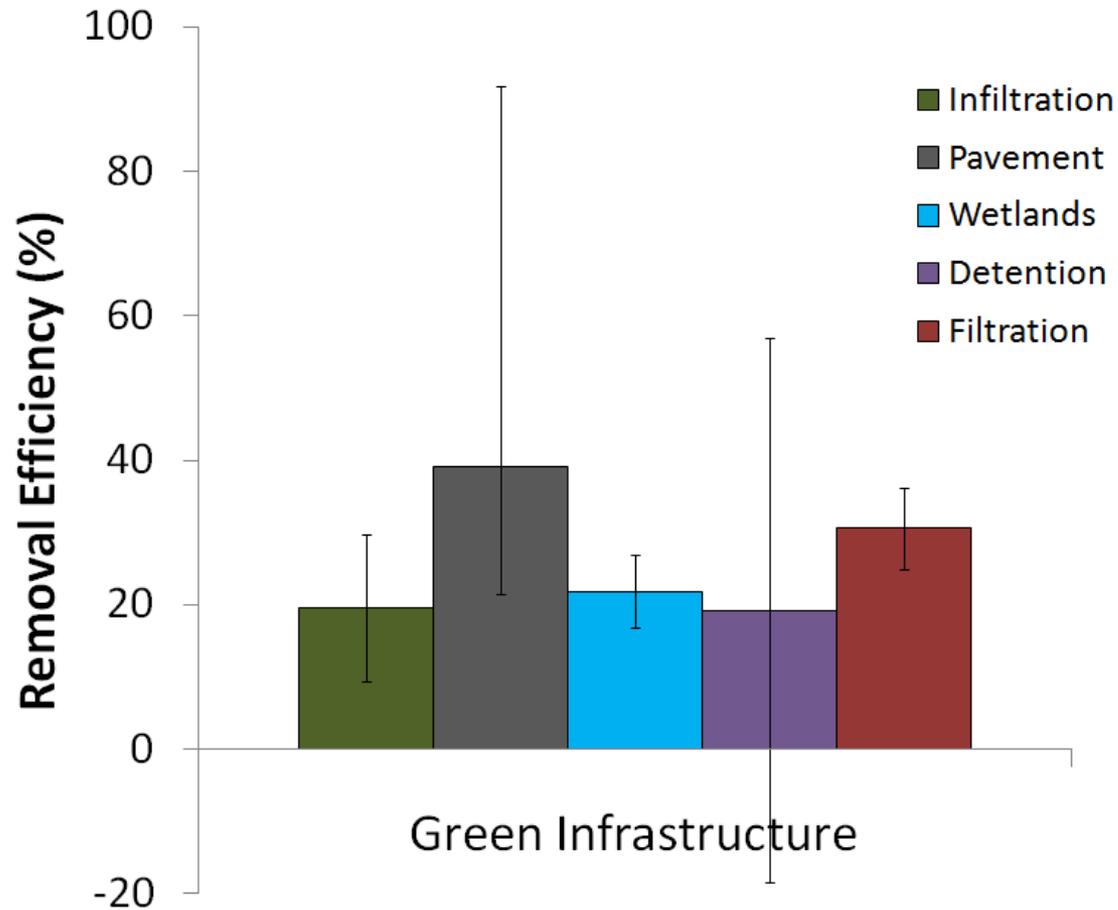
Effectiveness of green infrastructure for:

- Volume reduction
- TN reduction
- TSS reduction

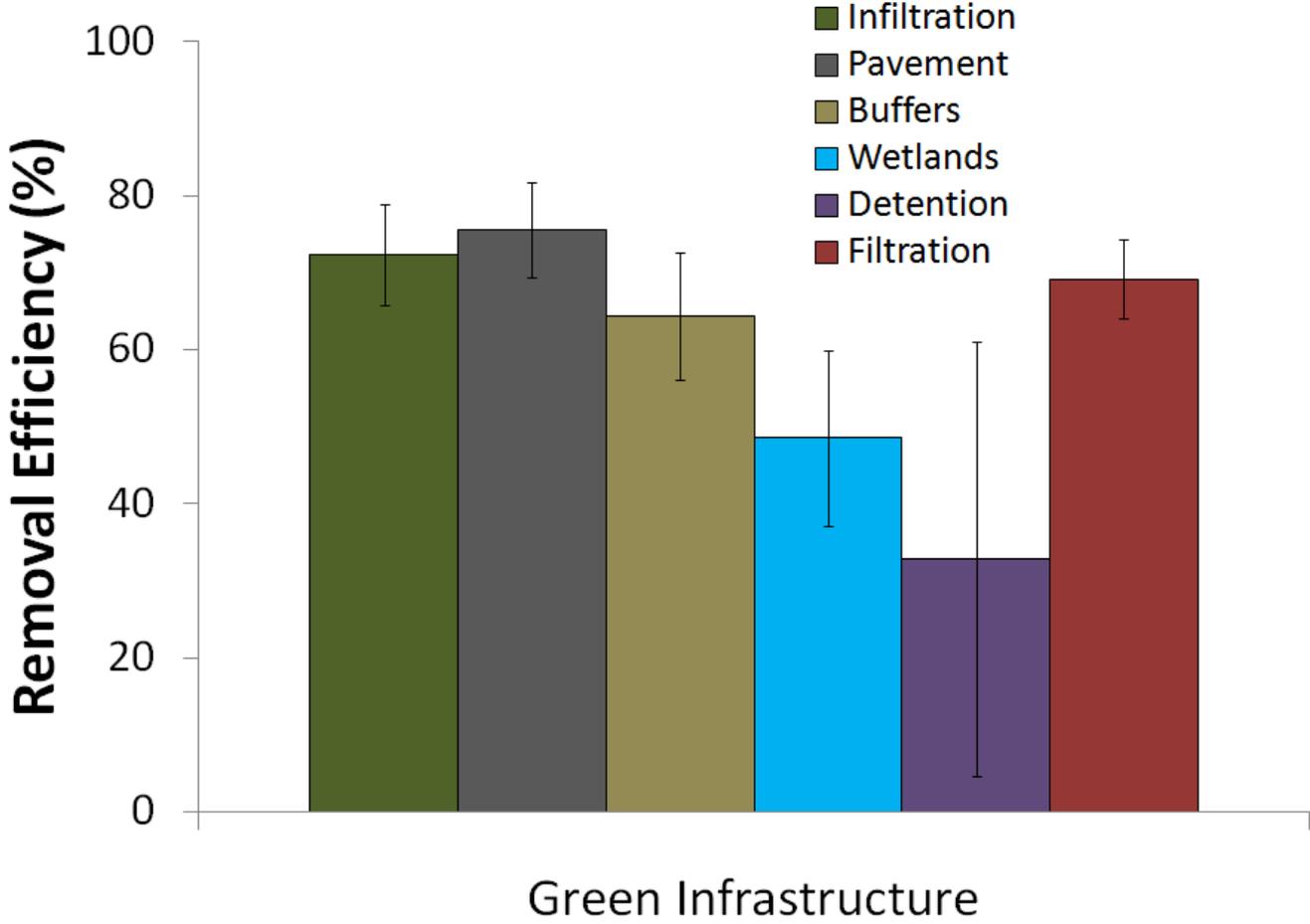
Preliminary Results - Volume



Preliminary Results – Total Nitrogen



Preliminary Results – Total Suspended Solids



Possible Sources of Variability

- Scale
 - Proper scaling of infrastructure
- Maintenance of infrastructure
- Variability in local conditions
 - Influent pollution
 - Soil permeability
 - Rain events

GOAL 2

- Use modeling to understand the role of spatial scale and pattern on effectiveness

Desirable Model Features

- Spatially explicit
 - How do layout and configuration matter over a regional scale?
- Ease of inputting data
 - Maps
 - Data from literature review
- Tracks the variables we are interested in
 - Volume
 - TSS
 - TN
- Flexibility to customize

Some Existing Models

- **SWMM**: Storm Water Management Model
- **P8**: Program for Predicting Polluting Particle Passage through Pits, Puddles, & Ponds
- **L-THIA**: The Long-Term Hydrologic Impact Assessment
- **HSPF**: Hydrologic Simulation Program Fortran
- **MUSIC**: Model for Urban Stormwater Improvement Conceptualization
- **AGNPS**: Annualized Agricultural Non Point Source

Scope of Study: CNT

- (d) The **costs and benefits** of green vs. grey infrastructure.
- (e) Existing and potential **new urban storm water management regulatory programs** and methods and feasibility of integrating a State program with existing and potential regional and local programs in Illinois
- (f) Findings and recommendations for adopting an urban storm water management regulatory program in Illinois which includes **performance standards** and **encourages the use of green infrastructure** to achieve those standards.

CNT Research

- State Survey
- Illinois MS4 Program
- Green Infrastructure Portfolio Standard
- GI Cost-Benefit Analysis

State Survey

Issues to watch:

Types of standards

- volume control, release rates, groundwater recharge, pollutant load, erosion, resource protection

Thresholds, exemptions

Flexibility

Green infrastructure requirements

Maintenance requirements

Illinois MS4 General Permit:

*New Requirements
for:*

**Small Municipal
Separate Storm
Sewer Systems**

General NPDES Permit No. ILR40

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand East
P.O. Box 19276
Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM General NPDES Permit

For

Discharges from Small Municipal Separate Storm Sewer Systems

Expiration Date:

Issue Date:

Effective Date:

In compliance with the provisions of the Illinois Environmental Protection Act, the Illinois Pollution Control Board Rules and Regulations (35 Ill. Adm. Code, Subtitle C, Chapter 1) and the Clean Water Act, the following discharges may be authorized by this permit in accordance with the conditions herein:

Discharges of only storm water from small municipal separate storm sewer systems, as defined and limited herein. Storm water means storm water runoff, snow melt runoff, and surface runoff and drainage.

Receiving waters: Discharges may be authorized to any surface water of the State. To receive authorization to discharge under this general permit, a facility operator must submit an application as described in the permit conditions to the Illinois Environmental Protection Agency. Authorization, if granted, will be by letter and include a copy of this permit.

Green Infrastructure Requirements in Updated IL40

- 1. Education**
- 2. Training of staff and contractors**
- 3. Best management practices**
- 4. Applicability to public surfaces**
- 5. Applicability to existing developed property**

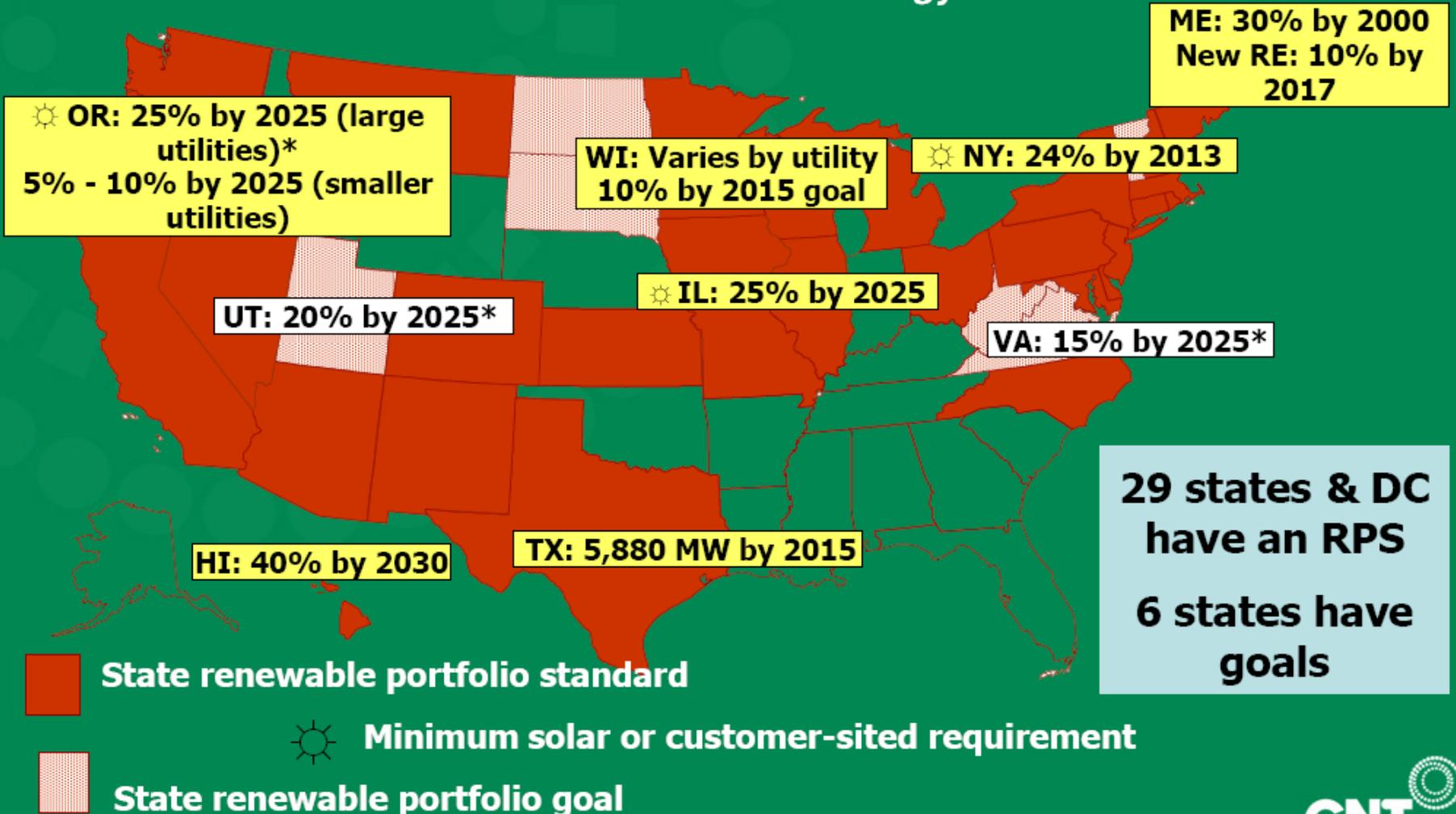
Green Infrastructure Portfolio Standard

Concept:

Establish a goal of gradually increasing the percentage of stormwater in an area that is managed with green infrastructure.

Renewable Energy Standards

From: Interstate Renewable Energy Council



Portfolio Standard Potential Elements

- Metrics
 - Type of goal to be achieved
 - Eligible green infrastructure technologies
 - Information technology; database
- Administrative body
- Enforcement or incentive mechanisms
- Maintenance program

Green vs. Grey

Costs and benefits of using **green** as compared with using **grey** infrastructure

Green Values Calculator®

GREEN INFRASTRUCTURE VALUATION

- What is Green Infrastructure?
- How Landscapes Work
- About This Site
- Resources

GREEN INFRASTRUCTURE CALCULATOR

Calculator

Green Interventions:

- Roof Drains to Raingardens at All Downspouts:
- Half of Lawn Replaced by Garden with Native Landscaping:
- Porous Pavement used on Driveway, Sidewalk and other non-street pavement:
- Green Roofs:
- Provide Tree Cover for an Additional 25% of Lot:
- Use Drainage Swales instead of Stormwater Pipes:

Site Statistics:

- Select a scenario: Dense Urban Neighborhood
- Is this an existing site:
- Total size of site: 5 acres
- Number of lots: 44
- Average Roof Size, including Garage: 1000 ft.²

Results

The difference between the conventional system and the green intervention(s) you chose **decreases** the total 100 year life cycle costs and **increases** benefits by \$46,286! This strategy reduces peak discharge by 44%.

Hydrologic | Financial | Financial Detail | Scenario Detail

Hydrologic Results

| Lot Level Improvements: | Conventional | Green | Reduction |
|--------------------------|--------------|-------|-----------|
| Lot Discharge (cf) | 547 | 258 | 52.8% |
| Lot Peak Discharge (cfs) | 0.16 | 0.07 | 55.5% |

| Total Site Improvements: | Conventional | Green | Reduction |
|----------------------------|--------------|-------|-----------|
| Total Peak Discharge (cfs) | 9.63 | 5.40 | 43.9% |

| Detention Size Improvements: | Conventional | Green | Reduction |
|---|--------------|--------|-----------|
| Total Detention Required (ft ³) | 24,090 | 11,151 | 54% |

Scope of Study: CMAP

- (b) Potential **urban storm water management performance standards** to address flooding, water pollution, stream erosion, habitat quality...
- (c) The **prevalence of green infrastructure use** in Illinois

CMAP Research

- Examining county (Cook, DuPage, Kane, Kendall, Lake, McHenry and Will) and local (Aurora, Homer Glen, and Crystal Lake) stormwater management programs
- Reviewing standards for:
 - Volume control measures
 - Runoff reduction hierarchy, release rates
 - Water quality management

Scope of the Study: IISGCP

- Illinois-Indiana Sea Grant College Program part of U-Illinois Extension – outreach and training mission
- Will develop Green Infrastructure **training materials and a dissemination plan** for Illinois EPA over the summer, 2010
 - Directed to downstate local government officials
 - Directed to downstate Regional Planning Agencies